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Floodplains: Balancing Nature and Human Needs

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Periodic Atlas of the Metroscape

Floodplains

Balancing Nature and Human Needs

by Vivek Shandas and Meg Merrick

For countless years, the interaction between climatic conditions and water flow has forged the rolling hills and rivers in the metroscape. The floods that forced a deluge of water down the Columbia River between 13 and 17 thousand years ago established the fertile and absorptive landscape of the Willamette Valley. The lush vegetation controlled the regional climate and stabilized the soils, while the thirsty wetlands reduced flood potential, provided habitat, and purified the water. Over geologic time, these natural processes have created ideal conditions for humans. The Pacific Northwest was home to some of the most densely populated communities of Native Americans, due partly to the mild climate, plentiful water, and abundant sources of food and shelter. In the 19th century, Anglo settlers flooded the region for the same amenities, which continue to create ideal conditions for all that the region is known for today, including hiking, kayaking, and sailing – not to mention the provision of climate, topography, and fertile soils for growing some of the world's best wines!

Land surveys from the 1860s suggest that the current form of the metroscape started to take shape at the end of the 19th century. The conifers, alders, and maples that covered the region were slowly removed to make way for new urban settlements, and wetlands were drained to create farms and agricultural areas. In this atlas, we journey 140 years into the past to examine how and where the metroscape has changed. Our aim is to illustrate historic flooding of the region, and ponder what changes might mean to its future.

The Absorptive Metroscape

Some of the earliest maps of the region illustrate thousands of acres of wetlands and abundant stream systems. The areas adjacent to the region's rivers were covered in vegetation, and the landscape was dotted with lakes and marshy wetlands.

Oregon survey maps, circa 1860, provide a window into that landscape. Figure 1 reveals the abundant springs, wetlands, and vegetation that existed in what is currently the Brooklyn, Westmoreland, Eastmoreland, and Reed neighorhoods in Portland. Figure 2 provides a similar picture of the area that is now Lake Oswego (Sucker Lake), West Linn, Willamette Falls, and Oregon City.

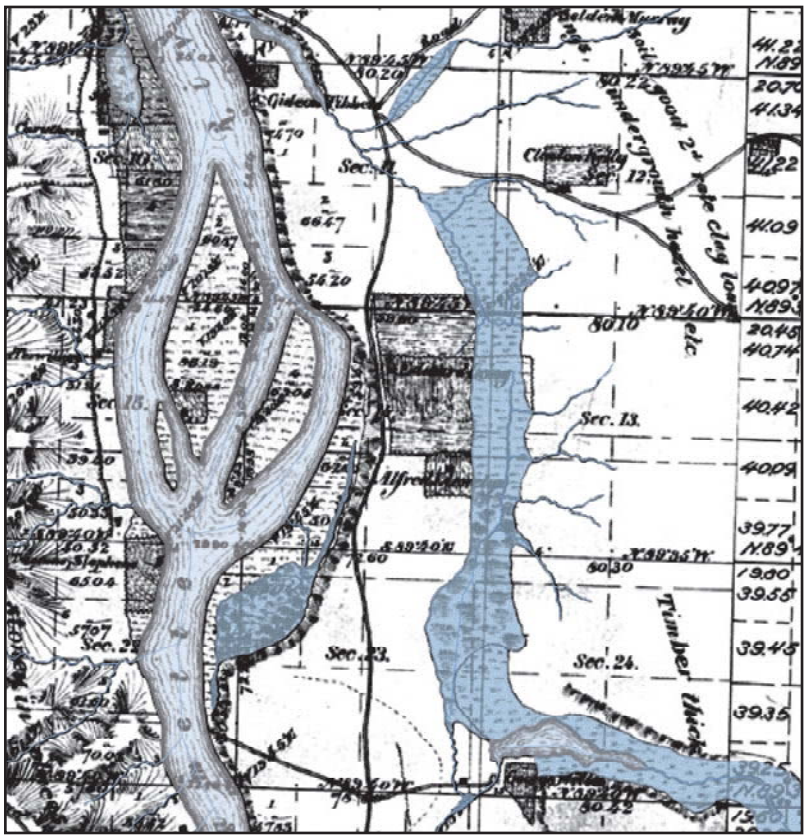

Figure 1 Sources: GLO Survey; Institute of Portland Metropolitan Studies

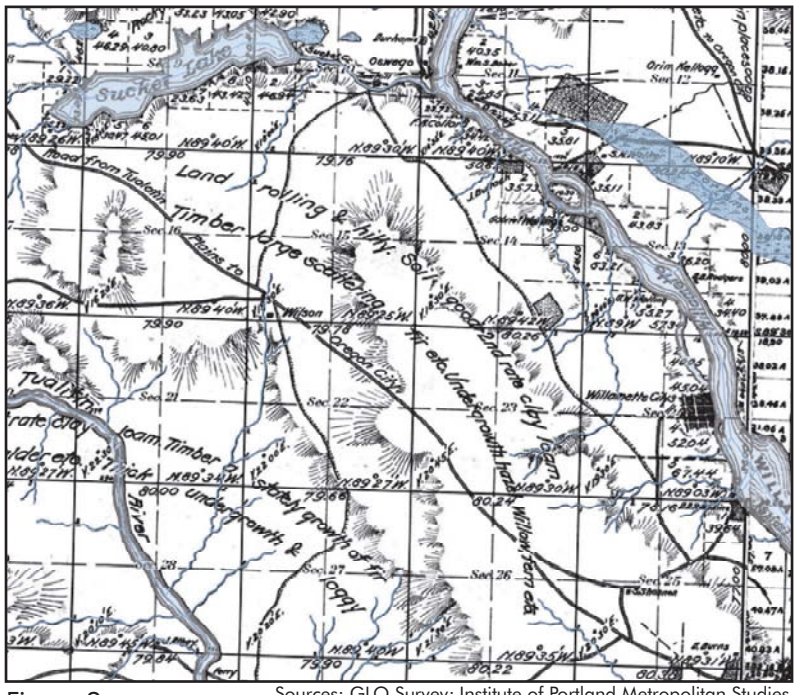

Figure 2 Sources: GLO Survey; Institute of Portland Metropolitan Studies

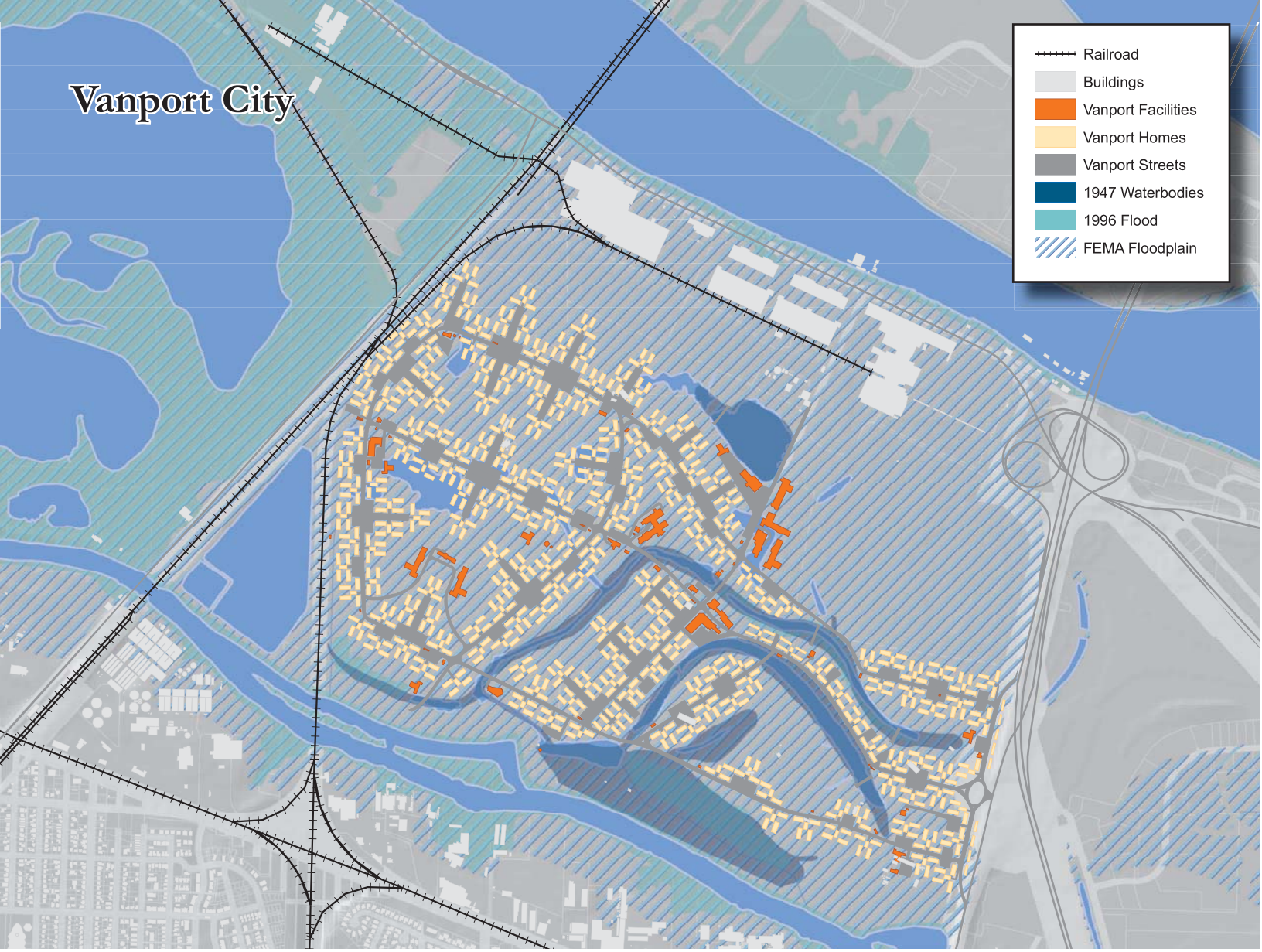

Figure 3

Sources: Institute of Portland Metropolitan Studies; Metro, RLIS

Rescuers man a lifeline out of Vanport, on Sunday afternoon, May 30th, 1948.

Changes to the Land

Urban development creates some of the greatest changes to landscape processes. Wetlands and small creeks, which intercepted water flowing across the landscape, were drained and covered with pavement and underground sewers. These impervious surfaces and artificial drainage systems were designed to remove water from developed areas as fast as possible. In addition, urban development has occurred in low-lying areas (even below sea-level) close to rivers in the belief that dikes would protect them from inundation. Since rivers were formed by carrying specific capacities and velocities of water, these changes have caused them to fill very quickly, resulting in floods.

Vanport City (built in 1943 to house wartime ship workers) provides a vivid example of what can happen as a result of these changes. Vanport was built on a former truck farm in an area that was below sea-level but was protected by dikes (where the Heron Lakes Golf Course and the Portland International Raceway are now located) (figure 3). On Memorial Day, 1948, after a period of rapidly rising temperatures and extraordinary spring runoffs, the rail dike broke, leaving Vanport City under water and nearly 20,000 people homeless.

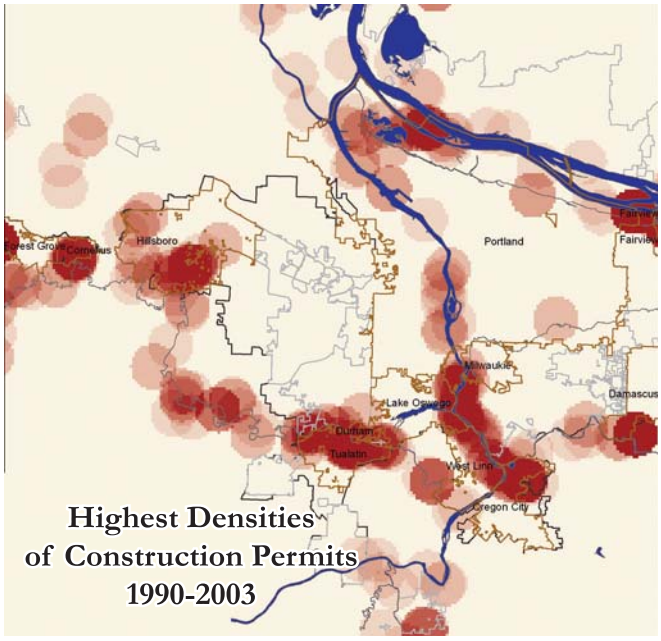

Figure 4 Source: Metro, RLIS

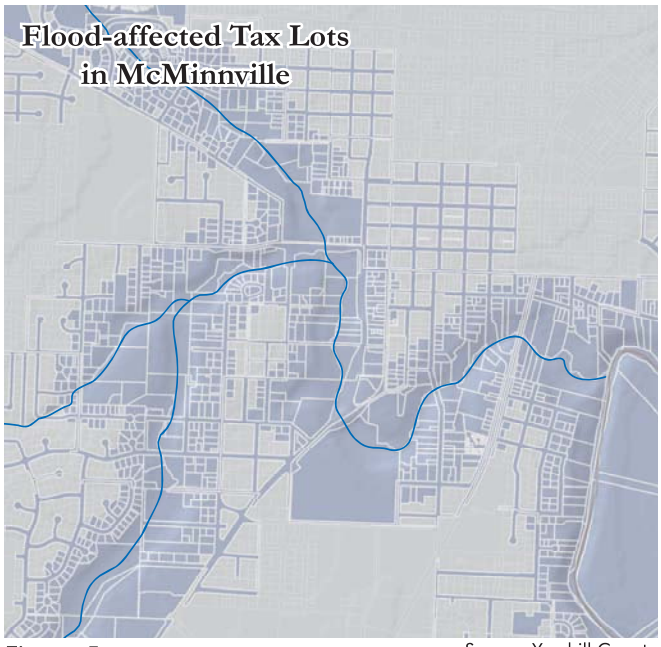

Figure 5 Source: Yamhill County

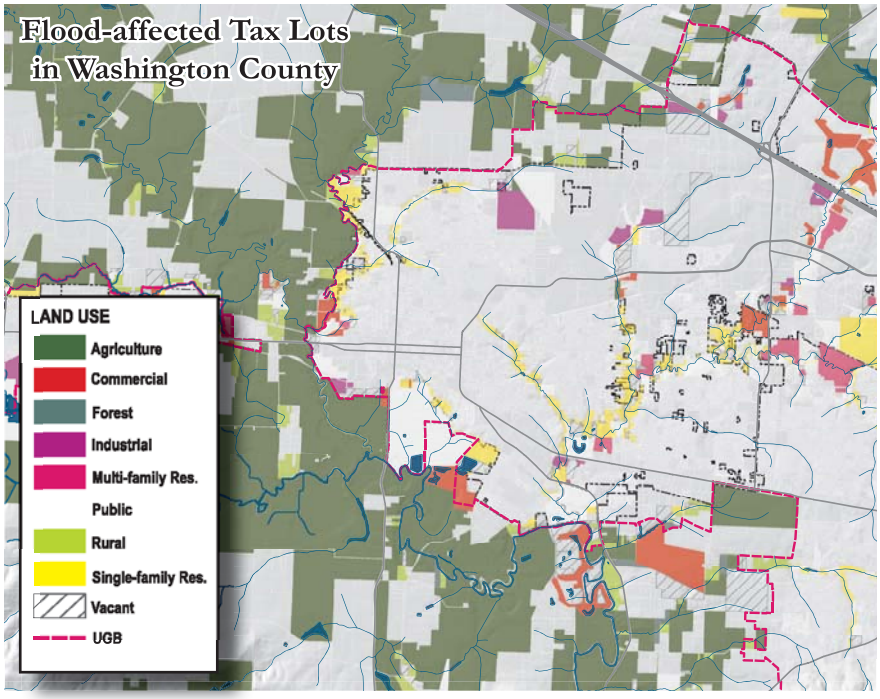

Figure 6 Source: Metro, RLIS

We continue to make alterations to the metroscape. Between 1990 and 2003, 366 permits were issued for development in the floodplain of a major river – the area where past flooding has occurred. Many, if not all, of these new developments are complete. While locating new permits may not provide information on the actual changes to the landscape, it does suggest where significant changes to the landscape are likely to have occurred. Drawing on this permit data, figure 4 identifies where the highest densities of new permit developments have occurred between 1990 and 2003. While much of the new development occurred along the urban growth boundary (UGB), seven areas stand out as containing the highest amount of new development permit activity: Forest Grove/Cornelius, Hillsboro, Tualatin/Durham, West Linn/Oregon City, Milwaukee/Lake Oswego, Damascus, Fairview/Troutdale, and North Portland. Of these, the southern and western parts of the region – Tualatin/Durham and Forest Grove/Cornelius, respectively – contain the largest proportion of the new permits during this time period.

A closer look suggests that people live and work in areas where floods have occurred. Of the 41,628 tax lots in Yamhill County, over 28% are located along floodplain. While many of these floodplain parcels are rural, often zoned as agriculture and public and vacant lands, the town of McMinnville shows that people living in urban areas are also susceptible to flooding. Figure 5 illustrates all the tax lots that are on the floodplain. While much of the dense urban development is not directly adjacent to the river, in the past large floods have affected all the parcels in blue.

A similar story is also evident in Washington County, except in this case we can see the types of land uses occurring in the floodplain. Figure 6 zooms in on an areas south of Highway 26, North of Farmington Road and East of the UGB. The figure suggests that large agricultural areas outside the UGB are in the floodplain, but several single-family residential (SFR) and multi-family residential units are also on the floodplain. These tax lots will be the first affected by major storms in our region.

The Floodplains of the Tualatin River 1860 and 1996

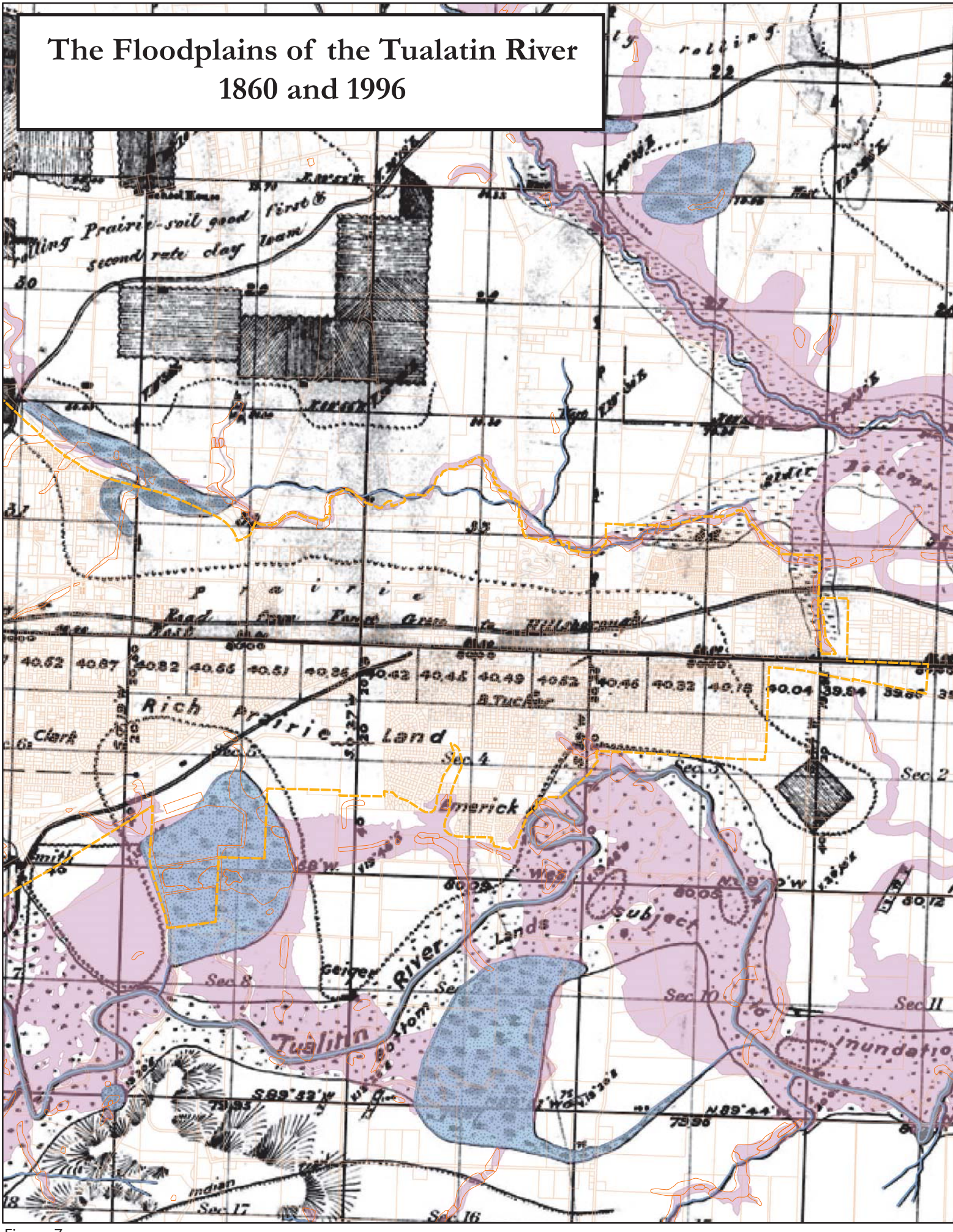

Figure 7

Sources: GLO Survey; Institute of Portland Metropolitan Studies; Metro, RLIS

Let's return to the circa 1860 survey maps to explore this question. As we have seen, two of the areas where development has been particularly intense in recent years are at the edges of the urban growth boundaries (UGBs) surrounding Hillsboro and Cornelius. These are also cities whose boundaries are largely defined by the Tualatin River and its tributaries. Figure 7 is comprised of the circa 1860 survey, including the surveyors' hand-written notes; digitized circa 1860 water bodies, streams, and wetlands; current wetlands (outlined in red); inundated areas as a result of the 1996 flood; 2008 tax lots; and 2008 UGBs.

The surveyors' notes on the 1860 map indicate not only a heavily vegetated landscape but significant areas of inundated "bottom lands" and wetlands along the Tualatin River that we know were flooded in 1996. Additionally, urban development, largely contained within the two cities' UGBs, are either abutting or encroaching upon these historic wetlands and bottom lands. Where and how Hillsboro and Cornelius choose to develop in the future will determine where pavement and preservation occur and what the consequences of those decisions may be.

A Warning from the Present

Over the past 11 years the region has experienced two 100-year floods. As the name suggests, a 100-year flood event is only supposed to occur every 100 years. While it is unclear precisely why these events have occurred within such a short time frame, several studies suggest precipitation has increased by 10% through the 20th century, and that through the 21st century, rainfall will increase between 20% and 50%.

These changes may be due to the recent floods that have affected small towns around the region. Vernonia, a town of approximately 2,200 people located in Columbia County, was severely affected by the last two 100-year flood events. Figure 8 illustrates the extent of the inundated land in Vernonia due to its 2007 flood event.

The combination of conditions (rapidly rising temperatures and historic rains) that caused Vanport to flood in 1948 came together in 1996 and again in 2007 to put the very heart of Vernonia under water. As a result of the 2007 event, hundreds of homes, businesses, and the town's schools were flooded. Landslides, downed trees, and high water hindered a timely delivery of supplies. And according to KATU news, the National Guard had to rescue more than 200 people.

After two devastating flood events in just 11 years, the City of Vernonia is using new flood maps developed from an Army Corps of Engineers study for the Federal Emergency Management Agency (FEMA) to guide future development.

The landscape that we have inherited is a complex mosaic of geologic activity, weather and weathering, and human innovation. By developing the land, we have changed its ability to absorb rainfall while allowing hundreds of thousands of people to live, work, and play in the region. How will we choose to accommodate the increasing population of the metroscape? This question lies at the heart of the choice we have to cover the soil with pavement or preserve its capacity to absorb the heavy rainfall that the rest of the nation and the world readily associate with the Pacific Northwest. M

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Courtesy of the Vernonia Police Department

Above and opposite page: Vernonia under water, December 3, 2007.

Flood Inundated Areas
Vernonia, 2007

Vernonia in 2008, from Google Earth.

Tax Lots

FEMA 2007 Vernonia Inundated Areas

Rivers

Figure 8

Sources: Columbia County; FEMA

Courtesy of the Vernonia Police Department